Design of Delta-sigma modulator using eSim and Sky130

ASHWINI KUMAR

Electronics and Communication
Engineering
Vellore Institute of Technology
Vellore, India
ashwini.kumar2020@vitstudent.ac.in

Abstract—**A Delta-sigma modulator is extensively used in digital communication to transfer data. The delay is generated using the Verilog code in Makerchip ide. Skywater 130 op-amp with other components like resistors is configured in adder and subtractor configuration. A 1-bit quantizer is also designed using the Verilog code in Makerchip IDE. The circuit is simulated in the eSim EDA tool developed by IIT Bombay.**

Keywords— op amp, Sky130, eSim, resistor, Verilog

I. REFERENCE CIRCUIT DETAILS:

Fig 1. It shows the block diagram of Delta modulator. From block diagram 1 bit quantizer output is delta when input is greater than 0 and output is –delta when input is less than 0. The delay block output is high when previous input is low, delay block output is low when previous input is high. Delay block and 1-bit quantizer is designed using Verilog Code in Makerchip IDE

The Skywater 130 op-amp is designed in subtractor configuration shown in Fig 2. The gain of op-amp in subtractor configuration is designed as 1 for Rf= R1=R2=R3

The Skywater 130 op-amp is designed in adder configuration shown in Fig 3. The gain of op-amp in adder configuration is designed as 1 for Rf=R1=R2=Ra

The output obtained at x[n] is plotted in eSim. The Fig 4. shows the sample output obtained at x[n]. The Delta modulated output is obtained at eq[n] as shown in Fig 1.
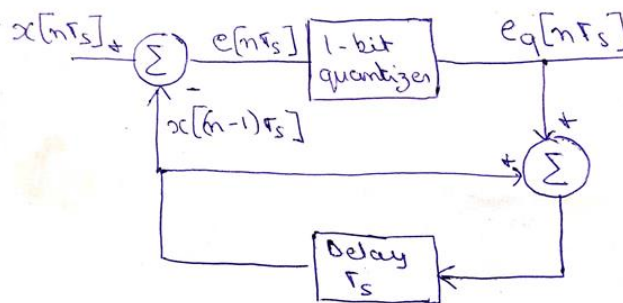
II. REFERENCE CIRCUIT DESIGN

Fig. 1.   Delta-Sigma modulator Block Diagram
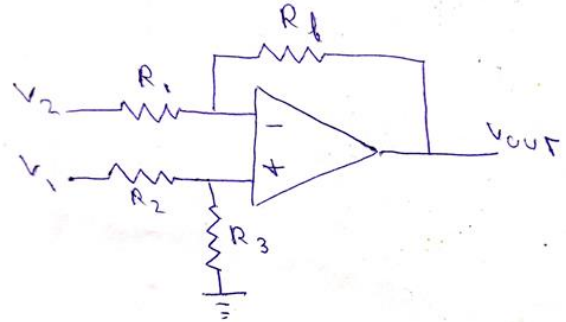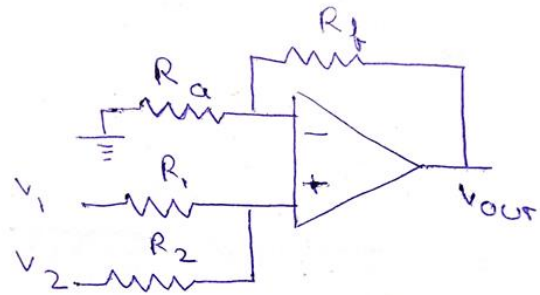
III. REFERENCE WAVEFORM

Fig. 2.   Subtracting junction of block diagram using Sky 130 op-amp, resistor

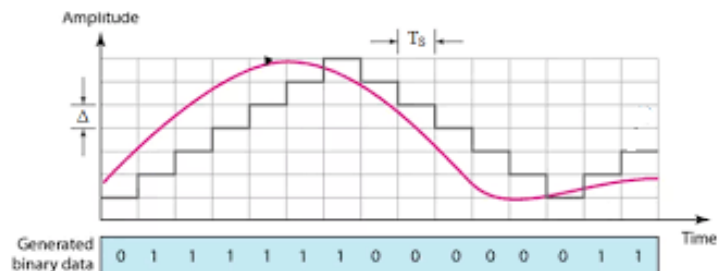Summing Junction of block diagram using Sky 130 op-amp, resistor

Fig. 3.   R-2R Digital to Analog Converter waveform output

REFERENCES

[1] B. Razavi, "The Delta-Sigma Modulator [A Circuit for All Seasons]," in IEEE Solid-State Circuits Magazine, vol. 8, no. 2, pp. 10-15, Spring 2016, doi: 10.1109/MSSC.2016.2543061.